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## **National Shipbuilding Research Program and Navy – Further Advancement Through Collaboration**

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### **ABSTRACT**

This paper discusses the Naval shipbuilding and repair enterprise from the vantage point of the National Shipbuilding Research Program (NSRP) collaborative of shipyards. The NSRP represents our Nation's shipbuilding and repair enterprise – both military and commercial. The paper will offer a relational perspective of the naval warship enterprise, from customer requirements and concept formulation, through design and construction, to life cycle maintenance. The paper will discuss the integrating tools and processes required for enterprise optimization, including the balanced application of lean principles and systems technology. The paper will outline challenges facing the whole, including acquisition constraints, requirements and specifications, needed investment, and arguably the most daunting - commitment to change. The process of even greater design, engineering, and production capability, based on advanced and more integrated computer applications, continues at an energetic pace. People, processes and tools have come together in a comprehensive way, in effect in a new culture, in order to really begin to take advantage of what is, in a sense, inherent in the tools. The paper will conclude with recommendations for the enterprise as a whole in meeting the challenges and continuing to provide the United States with the most advanced Navy in the world.

### **INTRODUCTION**

Many factors need to be considered when discussing the United States maritime industry. Too often, observation and discussion centers only on subsidies and

efficiencies. As much as any facet of the American economy, our shipbuilding industry is rooted as deep as our 225-year old Democracy's deepest roots. The handfuls of Maritime Regulations that govern today have their origins from a theme established following the American Revolution. The theme has been one of self-reliance to meet national emergencies and to foster a commercial maritime industry commensurate with our enormous dependence on trade. Additionally, factors including capital expenditures, material costs, wages, workman's compensation, environmental and safety regulations, and worker attraction and retention are driven by the forces of capitalism inherent to our business society. All of these are dealt with by an American shipbuilding business generally meeting the expectation that a profit will be made on the production and maintenance of each vessel. And, of course shipbuilding and repair has always been a subject for politics. Finally, another major consideration often going unacknowledged is that for all its woes, perceived and real, the US shipbuilding industry, in concert with the US Navy, continues to produce and maintain the most capable naval warships and auxiliaries in the world. Our fleet is engineered, produced, and maintained to go far, stay on station for a long time, and overwhelm the enemy. In this regard the results speak for themselves.

It is far too easy, when discussing the future status of US shipyards, to dwell on the glories of the past, the unfairness of the world's market forces and wishful thinking centered around "if only" scenarios that would solve all our problems. One could suppose that such thoughts are inevitable, if the person speaking was a member of the

industry during the blows that hammered the US shipbuilding and repair business in the late '80s and early '90s. For today's industry that is history and we have moved on.

The combined impact, during the 1980's, of the end of the 600 ship Navy, the end of Construction Differential Subsidy, the hiatus of Title XI, etc., were certainly blows that sent the industry reeling (Department of Transportation 1936). But in truth, America's shipbuilding and repair industry got off easy compared to other Western nations and generally didn't realize it. The period 1986 to 1993 was really hard for much of the industry. Shipyards closed. The industry contracted. Companies restructured. The initial reaction was typical of Western business practice; downsize, unload people and facilities, limit the damage. The portions of the industry that were viable polarized around their best customers. The industry split into three major groups. The remaining major warship builders found their interests were diluted by domestic issues, the domestic new construction yards focused on the few viable Jones Act markets such as the Gulf of Mexico, and the repair only yards thrashed around for meaningful work volumes that were captive to the US market.

Political support for the industry, while less effective with the reduced Navy shipbuilding budget, did not disappear. That support was the foundation of a broad program of positive actions signed into law by President Clinton in 1993 that started us down a path of meaningful change. Included in that program was DoD support for the long standing, but moribund, National Shipbuilding Research Program (NSRP) as well as a new initiative, Maritime Technology (MARITECH), under the control of the Defense Advanced Research Projects Agency (DARPA), which supported larger initiatives from individual shipyards.

The complete spectrum of initiatives supported by President Clinton happily coincided with a short lived boom in the

Gulf, some stability in the amount of Naval new construction underway, and a cheap US dollar that attracted some foreign owners to try the advantages of Title XI financing. The period from 1994 to 1997 was full of optimism, new orders, new "silver bullets," but disappointing results.

As these mixed results sunk in, a further painful lesson emerged. While the industry had shrunk, cutting capacity and "soft" costs, it hadn't fundamentally changed. We were still looking for that silver bullet that would result in the perfect "if only" solution to all our problems. If only we could have the ideal Computer Aided Design (CAD) drafting system...if only we could get the Japanese productivity without the need to understand how they did it and how much hard work it took to get it right. The shipbuilding and repair industry as a whole still had a hard time "getting it." The few shipyards that did "get it" tackled the fundamental issues of how they did the real work of building ships. They attacked the waste, the poor planning, the basic productivity of their processes, the attitude of their management and workforces, and more than anything else, the perception that they didn't have to absorb really deep change.

## **THE COLLABORATIVE FORCE**

In response to the National Defense Authorization Act of 1993, the Clinton Administration developed a comprehensive plan to enable domestic shipyards to compete effectively in the international market. In this plan, Strengthening America's Shipyards: A Plan for Competing in the International Market, the government called for a major national initiative in shipbuilding with the goal of assisting the efforts of the nation's shipyards to make a successful transition from military to commercial shipbuilding. This noble crusade had several key initiatives - among them the re-invigoration of the Title XI loan Guarantee Program - not just for low cost

government loan guarantees for new ship construction, but also for shipyard modernization. Additionally, of particular importance to those shipyards striving to improve their performance was the MARITECH Program, headed by DARPA. The emphasis that was placed on shipbuilding by the Clinton Plan was later diminished as politics, loan defaults and several aborted commercial shipbuilding programs for foreign interests adversely impacted Title XI and several other programs aimed at making US shipbuilding competitive worldwide. However, much good did transpire from the initiative, the resulting MARITECH Program was a major force in placing many of our shipbuilders on the right path. MARITECH aided in developing and adopting advanced technology to improve commercial competitiveness, and in the process provided the industry with some vital tools for reducing the cost of naval shipbuilding. More importantly, it created an environment that fosters cooperation among competing domestic shipyards. US shipbuilders recognized that by combining their resources, they could accelerate the rate of improvement across the entire shipbuilding enterprise. It became clear during this program that creating a competitive US shipbuilding industry was a bigger challenge than was generally recognized at the beginning of MARITECH. Nonetheless, a detailed review of the program showed success in closing the gap. MARITECH aided shipyards in building ships, developing designs, improving business and construction processes, and enhancing facilities (Potomac Institute for Policy Studies 1998).

## **THE NAVY'S CHALLENGE**

As the five-year pre-ordained life span of the new MARITECH program was coming to an end, both the Navy and the industry knew that we hadn't got it completely right. The Navy, through the vision of Mr. Paul Schneider, then Executive Director, Naval Sea Systems Command, now Principal

Deputy Assistant Secretary of the Navy for Research, Development and Acquisition, did recognize the benefits of collaboration that were beginning to transcend with MARITECH. The resultant challenge simply was that if the shipbuilders could come together on shipbuilding process R&D, eliminating redundancy in efforts, the Navy would support the initiative on a shared basis. The challenge centered on the shipbuilders being able to move past processes being the competitive discriminator, recognizing that stove-piped process R&D only erodes the Navy's ability to fund the enterprise. The Navy required the economy of scale associated with the shipyards collaborating on shipbuilding R&D. Properly challenged by the Navy to come up with a better plan, the industry came up with a truly collaborative approach with continued support by the Navy for shipbuilding R&D that would really make a difference. The restructuring that led to the MARITECH Advanced Shipbuilding Enterprise (ASE) in 1997 was the result.

During the spring of 1997, an effort began to establish a collaboration of US shipbuilders with the purpose of developing and executing a shipbuilding R&D program as a MARITECH successor. The concept for a follow-on program differed from the original MARITECH in that the industry would plan and direct the R&D in a cooperative, collaborative manner. Shipyards would work together as well as with the supply chain.

The existing National Shipbuilding Research Program (NSRP) infrastructure was seen as a better alternative to establishing a "new" organization. The original NSRP program, established in 1970, selected and funded smaller projects that tended to be more shipyard specific. In the original NSRP model, its Executive Control Board (ECB), consisting of senior executives from US shipyards, helped create the Society of Naval Architects and Marine Engineers (SNAME) Ship Production Panels who then became responsible for conducting projects

selected by the ECB. The nine shipyards that were active participants in the NSRP ECB, challenged with engineering a post-MARITECH program, worked together over a nine-month period to execute articles of collaboration sufficient to establish a vehicle for government cost sharing of an industry-led effort.

DARPA's MARITECH program office agreed to provide limited funding during 1998 to develop a consensus industry strategy for future collaborative R&D investment. The result of these efforts was the combination of the former MARITECH Program and NSRP, aptly called MARITECH Advanced Shipbuilding Enterprise (ASE). This program was strategically structured to place industry in a position to control its own destiny. The ECB of NSRP took the lead in forming the collaborative organizational structure required to develop and administer a landmark, industry wide strategic R&D investment plan on a cost-share basis with government.

A key element of the new MARITECH ASE program was the sharing of technologies developed in the program with the collaborating shipyards and the industry at large. The SNAME Ship Production Panels, also restructured in 1998, became the industry forums that project participants continue to primarily use for technology transfer.

## **THE STRATEGIC INVESTMENT PLAN**

In addition to forming the collaboration, the five-year Strategic Investment Plan was developed to provide a roadmap for future research and development investments (National Shipbuilding Research Program Executive Control Board 1998). The Strategic Investment Plan (SIP) includes elements of a strategic plan, business plan, investment portfolio and R&D roadmap -- integrating technological advances with a sound, persuasive business plan.

Accordingly, developing the SIP was strongly oriented towards developing an execution plan to put strategies in motion rather than an academic exercise in analysis.

Key characteristics of the SIP planning process were:

- Priority on reducing the costs of materials as well as improving shipyard production processes
- A rigorous mathematical decision-making model to rate proposed strategies by cost-to-benefit ratio
- Inclusion of the broad marine value-chain, including many shipyards, suppliers, customers, academia government and classification societies
- Use of market analyses and forecasts from industry and government studies and consultants
- Review of multiple benchmarking sources and databases
- An understanding of the need for frequent updates and feedback from industry, customers, academia, and government

The Executive Control Board began the top-down process by drafting a concise mission statement and a vision for the industry and establishing a core planning group to develop the Strategic Investment Plan. The core planning group was comprised of senior managers from US shipyards and a coordination team from Advanced Technology Institute, the program administrator chosen for MARITECH ASE. The planning group's initial situational analysis of US shipbuilding acquired a broad understanding of the factors that affect the industry and of the variety of perspectives on the current industry situation (National Research Council 1996). These perspectives included the shipyards as well as consultants, government, academia, classification societies and customers. The resultant plan became a living, working business plan designed to guide the investment of NSRP ASE funds.

Major initiative investment areas, modeled in part from the National Research Council report, "Shipbuilding Technology and Education," of 1996, and the action plan to implement them form the technology core of the plan, and hence the program. These initiatives, Business Process Technologies, Product Design and Material Technologies, Systems Technologies, Shipyard Production Process Technologies, Facilities and Tooling, and Crosscut Initiatives (Education and Training, Technology Transfer, Culture Change and Human Resources) received resounding validation from the broad industry.

In any industry, constructing an investment portfolio requires judgment about the future. It requires professional opinions, tempered with facts, experience, peer discussions, and discussions with customers, regarding tradeoffs and choices among the alternatives. The clash and conflict of divergent judgments adds definition to the tasks, improves understanding and insight, and enriches the rationale behind the investment portfolio. After gathering input and ideas, analytical portfolio planning tool techniques were used to set priorities for investment in the major initiatives across market segments. The product of the planning effort is a focused investment portfolio, that is, an optimal investment strategy and ordered list of initiatives for funding, consistent with the participants' collective judgment. Investing funds using that strategy will provide the greatest expected benefit for the investment, whatever the total amount invested. The draft Strategic Investment Plan was widely publicized as part of an active effort to get feedback from the US maritime industry stakeholders. The feedback received was considered and factored into the plan as appropriate. The original Strategic Investment Plan was issued on August 14, 1998.

Not only did the process above produce a landmark strategic plan for the shipbuilders; it also provided the foundation for

fundamental changes among industry stakeholders. The process produced consensus national priorities, created a common vocabulary between corporate cultures, spawned new corporate and personal relationships...and created a team spirit in taking on national challenges as collaborators rather than competitors.

## **THE COLLABORATION AS A RESOURCE**

In 2000, it became evident that MARITECH ASE was growing beyond just a research and development program. The development time coupled with two years of execution resulted in a very productive environment with the shipbuilders. The ECB matured and expanded to become a learned body bringing synergy to the industry. At this same time, VADM Pete Nanos, COMNAVSEA, realized the utility afforded by NSRP. He met directly with the ECB and communicated concerns and opportunities. Since gaining insight to this initiative, VADM Nanos has continued to support NSRP. The NSRP ECB recognized certain industry needs and became involved in standards coordination and industry analysis and planning, such as benchmarking, and sourcing and supplier integration. At the executing level, the professionals comprising the ranks of the Major Initiative Teams and Panels have successfully cross-pollinated the many cultures. MARITECH ASE also became the funding source for special studies conducted by the Ship Production Panels. Additionally, Naval Surface Warfare Center, Carderock Division, has used the ECB in the capacity of an "Industry Advisory Board." In this capacity, the direction of the Navy laboratory is communicated and discussed. In order to reflect the expanded role the program was taking to accelerate the improvement of the US shipbuilding industry, MARITECH ASE became the National Shipbuilding Research Program Advanced Shipbuilding Enterprise (NSRP ASE).

In addition to the funds provided by NSRP ASE, the Office of Naval Research (ONR) has worked with the collaboration to provide over \$8 million in funds, to date, for shipbuilding research through the Small Business Innovative Research Program, the Small Business Technology Transfer Program, and the Manufacturing Technology (MANTECH) Centers of Excellence. These funds are provided through ONR programs based on the Strategic Investment Plan. As a further benefit, some of these projects are funded through ONR's new Shipbuilding Initiative that incentivizes the shipyards and the Centers of Excellence to work as teams.

Although academic institutions participate in NSRP ASE, they're contributions are somewhat limited due to several factors. In a cost share environ, academic institutions must have a partner willing to assume their burden of the required share, in addition to their own. Secondly, the research focus of NSRP ASE is more process focused rather than product focused. Therefore, a research institution with R&D efforts aimed at the next generation warship would be challenged to find a home in NSRP ASE. This facet of naval engineering development is recognized and the ECB of the NSRP is working with ONR, NAVSEA, and the academic institutions to construct a model supporting this important sector of naval engineering research. The marriage of the two efforts is a natural in that the development of the workforce and the technology transfer elements involved are exactly in step with the NSRP ASE Crosscut Major Initiative area.

## **SHOWING RESULTS**

NSRP ASE was established to aid industry in developing and adopting advanced technologies selected for their potential industry-wide benefits. This high-leverage, broad, collaborative approach was conceived to provide industry-wide improvements on the scale necessary to move US shipbuilding to a more competitive

position internationally and yield much more affordable Navy ships. Improvements made now before production of DD(X), T-AKE, CVN(X) and other programs planned in the decade (and early in the production of VIRGINIA and LPD-17) will prove particularly valuable to the Navy.

In the first two years of implementing the Strategic Investment Plan, 22 R&D projects were awarded \$114M in combined program funds and cost share. As NSRP ASE projects progressed during 2001, a track record developed that demonstrates the program's success towards stated goals. Project achievements illustrate the scope of NSRP's activities and provide early evidence that the expectations of substantial ROI from this program are well justified.

The current iteration of Navy supported R&D is considerably different than anything that has been tried in the past. It is truly a collaboration, the results in almost all cases, are shared with the entire industry. The industry is, and feels, accountable for the way the money is spent and the results obtained. We recognize the hard work that is ahead of us as we deal with the real problems of productivity, waste, poor management and the resistance to change that has been the metric of our industry for far too long.

The accepted picture of what makes a shipyard facility is changing. In general the industry is over-facilitized, although time is fixing that, and the cost driven self evaluation that is underway has lead to less, rather than more, investment in facilities, with a few notable exceptions. Most investment is being applied to processes, changing the way we do work versus what we do work with. Shipyards are specializing in the key areas where true value can be generated. Alliances with complementing suppliers and subcontractors are more valuable than ever.

As these changes take root, more and more of the management skills available in the

broader industrial base of the country have become welcome in shipyards. The willingness to seek out and bring in new skills and experience is a broadening trend. It is a trend that recognizes that the "past practice" of shipyards was ineffective and needed to change. The current applications of "Lean" techniques, developed in the manufacturing world are finding great relevance in shipyards, as are smarter procurement and design practices.

One aspect to note is the industry's understanding of system technology successes and liabilities. In the case of tool application, the shipbuilding and repair yards recognized the need to examine legacy processes in lieu of simply applying "out-of-the-box" solutions. This process engineering takes time and considerable fortitude on the part of both the workforce and the customer.

Another key area of great improvement that cannot be understated is the improvement in worker's compensation type injuries and related costs. Initiatives, started ad hoc by individual shipyards, have been focused through NSRP funded panels and the overall trend of improvement in safety related costs is spreading across the industry. The historical acceptance of the axiom that "shipyards are dangerous places" is being proven wrong and in a few more years of diligent effort the safety record of the industry will be as good as, or better, than comparable industries nationwide. These results, over time, will become apparent on several fronts - bottom line workman's compensation costs and worker attraction and retention.

A sample of specific project accomplishments illustrates the above points (National Shipbuilding Research Program website):

Lean Manufacturing projects exhibited immediate 30% productivity improvements in pilot tests at Todd Pacific Shipyards, leading both Todd and Atlantic Marine to accelerate implementation. National Steel

and Shipbuilding Company (NASSCO) has realized significant bottom line improvements in quality, production cost and cycle time as a result of lean manufacturing practices implemented, in part, under the World Class Manufacturing project. Based on these demonstrated results, most major US yards (both private and public) report efforts to accelerate the application of lean manufacturing, including the automation of steel handling and distortion control. Atlantic Marine, Todd Pacific, Bath Iron Works, Electric Boat, and Puget Sound Naval Shipyard anticipate greater than 20% improvement in overall productivity as a result of lean implementation.

Several teams are developing long-needed industry standards. A NASSCO-led team has delivered more than 500 commercial design standards, developed and commercialized parametric design tools, and demonstrated the application of Design for Manufacture and Assembly principles.

Electric Boat rapidly implemented early results of a joint industry and supplier eBusiness project to reduce costs and cycle time on the VIRGINIA Class SSN program, with over 400 active users, including EB and Newport News employees, suppliers, and the Navy's Supervisor of Shipbuilding (SUPSHIPS). As part of this industry-wide project, a bidding system prototype has been demonstrated at Bath Iron Works, while Ingalls and Avondale are actively developing and implementing similar tools - all shared throughout the industry on a common eBusiness network developed under NSRP ASE.

NSRP ASE's laser project with Bender Shipbuilding achieved an 8% reduction in steel plate usage, 30% reduction in steel cutting costs, and a substantial reduction in fitting and welding labor on sequential, identical ship projects. Based on these impressive results and the open sharing of this work, Electric Boat is investing in new lasers and the DD(X) and CVN(X) programs



are each sponsoring follow-on R&D in laser cutting and joining.

In the Information Technology (IT) arena NSRP ASE's largest project is focused on an Integrated Systems Environment. The team has developed, implemented, and successfully demonstrated a consensus IT architecture for the complex engineering information that is increasingly shared among a growing number of partners in co-design and co-production teams. This particular area was identified by a high-level Navy-Industry study group last year as the top priority for Navy shipbuilding IT investments.

Teams from industry, government (regulators and users) and universities are successfully working together to jointly develop and endorse industry skill standards, consensus voluntary ergonomics standards, and techniques to improve worker safety. The Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) publicly cited NSRP's ergonomics project as the 'Gold Standard' for effective cooperation between industry and government towards the goal of increased worker safety and productivity. Among several examples, Atlantic Marine and Todd Pacific Shipyards have implemented ergonomic improvements in ultra high pressure water blasting techniques that significantly increased productivity (40% gain) in a very short period – improvements now being sharing with other public and private yards.

NSRP ASE's strong focus on collaboration has created an unmistakable and very positive change in industry culture in a short period of time. The program's greatest strength lies in the collaborative nature of its operations, which incentivizes project teams consisting of multiple shipyards, suppliers, academia, and others. As a result, the learning and results of projects are broadly distributed throughout the industry, and projects are often implemented in multiple

shipyards simultaneously. In simply looking at the above examples, one can see that NSRP ASE provides a model for collaborative relationships. These examples illustrate teaming of big and small, military and commercial, shipyard and customer, and shipyard and regulator.

## **FORMIDABLE CHALLENGES AND REAL OPPORTUNITIES**

Although progress, like that noted above, is being made, there are still many challenges and obstacles to overcome. The Quadrennial Defense Review (QDR) issued September 30, 2001 recognized much of the ongoing phenomena. It was a much-anticipated document in light of all the discussion of transformation, coupled with the unfortunate and unprecedented acts of September 11, 2001. Upon release, the document was criticized for lack of specifics, however it rather clearly acknowledged the detriments of the current environment. It stated that a robust research and development effort is imperative to achieve the Department's transformation objectives. It then proceeded to recognize that government programs are no longer the primary impetus for research into new technologies, particularly in computers and materials. It acknowledged that the Department has embarked on an effort to (a) turn to private enterprise for new ways to move ideas from the laboratory to the operating forces, (b) tap the results of innovations developed in the private sector, and (c) blend government and private research where appropriate.<sup>1</sup> Refreshingly the document immediately notes that the Department must put forth parallel priorities on test and evaluation. This illustrates the intent to make good on the R&D – getting it to the warfighter.

In discussing the revitalization of the DoD establishment, the QDR states the following, "An infrastructure that needs to be

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<sup>1</sup> Quadrennial Defense Review Report, September 30, 2001; Section V, Creating the U. S. Military of the 21<sup>st</sup> Century.

streamlined to match the new reality, financial systems that limit the ability to see and manage the enterprise, and processes that discourage action and reasonable risk at the working level are hallmarks of a mature enterprise that must be transformed." Public-private partnerships are also discussed, concluding that functions will be assessed against three categories: (1) directly linked to warfighting and best performed by the government, (2) indirectly linked to warfighting and must be shared by the public and private sector, and (3) not linked to warfighting and best performed by the private sector.<sup>2</sup> Admittedly, none of these discussions are specific; however, they do exhibit a willingness to provide a framework for progress.

Senior shipbuilding executives from the military shipbuilders testified their concerns before the Seapower Subcommittee of the Senate Armed Services Committee on April 4, 2001. They were each asked to offer testimony on several issues regarding the status of the shipbuilding industrial base and initiatives to improve cost control, predictability and alternative funding approaches. The following three short excerpts offer a glimpse of their overwhelming agreement on the issues.

Testimony excerpt of Mr. John Welch, Senior Vice President, General Dynamics Corporation: *"Although we have sized ourselves to low rate production and had many success stories, major challenges still face the shipbuilding industry as well as our customer, the US Navy, to provide the quantity of ships and submarines and the warfighting capability needed to recapitalize our naval forces. These challenges are further exacerbated by the significantly lower production volumes in our shipyards compared to a decade ago. This low production volume, and attendant peaks and valleys in workload, result in increased*

*production costs driven by less than efficient utilization of our resources. The uncertainty of future workload compounds these challenges as it serves to limit our ability to plan for and invest in our businesses, absent the assurance of a reasonable return on our investment. Further, while we strive to introduce new technology and capability into new ship designs, the budget constraints imposed on the Navy's shipbuilding programs seriously limit these efforts. Lastly, we cannot overlook the fact that, despite the best efforts of industry and the Navy, the risks of construction cost growth and schedule delays are an inherent part of building complex warships in a constrained budget environment. Repercussions from one mis-step are felt by all. If a problem evolves with any one program, all members on this panel share the burden of recovery."*

Testimony excerpt of Mr. Jerry St. Pe, former Chief Operating Officer, Northrop Grumman Litton Ship Systems: *"In addressing some of the specific issues before this subcommittee, let me start by saying that we all know that building Navy ships is, and will always be, an expensive business. Clearly, though there are ways that we in industry can partner with our customers – which in my mind includes not only the US Navy, but Congress as well – to remove some of the current obstacles to improving productivity and cost efficiency. It should be said up front that the maintenance of a healthy shipbuilding industrial base that can produce ships at the lowest cost to the taxpayer depends on three key factors: A stable, long-term shipbuilding plan; adequate numbers of ships to utilize efficiently the shipbuilding capacity we have; and a commitment on the part of shipbuilder to invest in shipbuilding facilities, processes and technology."*

Testimony excerpt of Mr. William Fricks, former Chairman and Chief Executive Officer, Newport News Shipbuilding: *"The current condition of the shipbuilding industrial base is that it is surviving but struggling. The quandary for shipbuilders*

<sup>2</sup> Quadrennial Defense Review Report, September 30, 2001; Section VI, Revitalizing the DoD Establishment.

*today is that the Navy has stated a need of 300 to 360 ships which is the equivalent of 10 to 12 ships per year, yet we continue to build about half that many. So the industry's challenge is whether to invest in a program to upgrade facilities for twice the workload or continue to retrench to build the number of ships that are actually being authorized each year. In order to realistically assess the future of the industrial base, it is critical to know how many and what kinds of ships are going to be built. Throughout this testimony, you will hear me repeat a very critical word and one I'm confident you will hear from the other shipbuilders. It is the watchword of the industry. The word is stability. We need stability to strengthen and improve both the industrial base in general and the individual programs. We need a commitment from the government to define and stay the course with Navy shipbuilding programs. Many of you have heard about the low cost shipbuilding in Japan and Korea. I have been there many times. We have worked with their companies and we have walked their factory floors and their dry docks. There is no mystery to their low cost model. They have stability in production. They have stability in design. Because of that, they can invest heavily in their plants and in their up front planning. These investments pay large dividends in reducing costs. Although the ships they build are almost exclusively commercial, and not as complicated as military warships, the model works for both. The US shipbuilding industry stands ready to make those same kind of investments once it becomes clear we have a dependable future market. That is not to say that this industry has not invested in itself. Newport News has invested more than a billion dollars in the last 12 years. These investments, in computer-aided design, robotic manufacturing and new facilities, have enabled us to substantially reduce the man-hours required to build carriers and submarines."*

In considering the above remarks, also consider the opportunities it presents. Each of the shipyard executives quoted before

Congress discussed the need for stability and predictability. As the Navy, Congress, and industry leadership grapple with those issues, the program level Navy and shipyards need to position the enterprise in order to enhance any improvements gained in acquisition stability and predictability. The Navy needs more ships than it has the budget to build. The best way to remedy this adverse situation would be for the productivity of the program to rise sharply.

In order for the productivity of the naval shipbuilding program to improve significantly the relationship between the Navy and the corporations executing the Navy's shipbuilding program needs to change. The industry has downsized to the point today that there are six major builders distributed in two corporations, Northrop Grumman and General Dynamics. Of course, budget cuts and the related process of acquisition reform have wrought changes in the naval shipbuilding program, but the changes needed for a giant step forward in the productivity of the program have not been taken nor even addressed by the Navy. The patterns of behavior that evolved over the many years from WWII through the Cold War are still, for the most part, in place, albeit broken in many instances. The naval shipbuilding and repair program is more than just the contracts with the shipbuilders to design, build, and maintain the Navy's ships. The program includes the R&D that will create new capabilities in future ships. Curiously, a paradox has emerged in the relationship of the Navy to the shipbuilders. While acquisition strategies are conceived to give industry, shipbuilders plus combat system contractors, more say technically in the design chosen to meet requirements, as in DD(X), the legacy roles in the process for the various government activities have not been fundamentally changed. They have more been disconnected in some ways, than eliminated. The result is confusing. Money is spent, decisions are deferred, and program productivity suffers. The way is open to a much tighter relationship between the Navy and its

shipbuilders, eliminating the cost centers no longer needed, to add value to the program and to take advantage of the new design and construction concepts and methods to increase program velocity.

The area of military specifications is an example of this point. A broad-based reform was enacted to garner savings from the elimination of costly military specifications. The thought progressed nicely through the obvious. Once the "Kapok life jackets" took their place in history, the process continued into meatier areas such as materials and fasteners. Acquisition reform's affect on this foundation of the quality of the Navy product, and the lack of a concerted going-forward plan, is to the point of repeatedly taxing programs with the disposition of "cancelled" military specifications. Instead of addressing the whole, taking the necessary concerted effort with regard to the "commercialization" of military specifications, each and every program is left to live with the effect of broad-based cancellation and the expensive need to engineer adequate replacement. The Planning Yards and Shipbuilder Design Agents that reside in the collaboration of NSRP are a ready resource to the Navy in their quest to rationalize military specifications. The shipyards, employing existing, collaborative web based tools, can ferret through the specifications and provide the necessary technical disposition. The outcome would be a well managed, non-duplicative process that results in specifications suited for affordability, while remaining technically adequate for the required performance of the product.

The Navy's DD(X) and the Coast Guard's Deepwater programs will stand as early examples of the "systems of systems" approach to acquisition. These programs have been characterized as providing ships that are, "a node on a network." Will these programs usher in a new era of acquisition that stands the tests of time, budget unpredictability, and standards of quality demanded and deserved by our armed

forces? Stripped down to its basic elements, NSRP ASE provides a framework for the required process engineering and best practice establishment. What makes it unique among like efforts is the collaborative environment, the shared stakeholder vision within its strategic investment plan, and the opportunity for cross platform benefits.

Opportunities within the initiative for both the acquisition and operations elements of the Navy are plentiful. Previous project examples cited SUPSHIP Groton working eBusiness solutions with Electric Boat for VIRGINIA Class supply chain management. That project offers the potential to grow into the life cycle support arena. Puget Sound Naval Shipyard is working with Atlantic Marine, Todd Pacific Shipyards, and Bath Iron Works on a project centered on the implementation of lean principles. Only recently have the ship repair yards become active in this era of significant self-improvement. The historical perception that all that mattered in repair work was speed and having available resources for "surge" is indefensible when scrutinized with modern management techniques. One of the great opportunities for improvement, with direct bottom line impact on the Navy is the overall management and execution of repair and overhaul work. This curtailment of available resources, brought on by the fact that shipyard wages have fallen far behind "up-town" rates is a clarion call to the customer and the shipyards themselves that things have to change. Smaller workforces and reduced numbers of facilities mean the application of lean processes to repair work is an absolute must. With a timeline far more urgent than the relatively sedate pace of new construction, change in ship repair has immediate benefits to the Navy. Paradoxically change in repair work is driven more by business processes than technology. This is fertile ground for meaningful change by the many faces of the Navy with results being quickly discernable. The shipyards feel that a concerted joint effort will immediately have a major ROI to

the Navy's maintenance budget. The willingness of the Navy to participate in an attack on waste in the project and contract management process needs attention at senior levels.

## **THE JOURNEY OF CHANGE**

One unarguable tenet of all of this discussion is the opportunity presented to this sector of US business and defense in the form of lessons on culture and change. Culture is inherent in all we do, from the role of government program manager to the industrial shipfitter. Changing these cultures is difficult and takes tremendous time, requiring long term commitment. The change must be rooted at the top of the organization – it is truly a “lead-by-example” initiative. The backbone of its success must be based on communication. Keeping all stakeholders up to speed on the business at hand is essential to success. Culture must be recognized as the ‘nerve center’ of the organization – the cause and effect to every aspect of the business. Once acceptance to change is gained and fostered, it becomes the lubrication and fuel enabling the journey.

## **CONCLUSION**

NSRP ASE addresses an otherwise unmet need for Federal support. In a business environment where defense R&D is not profitable and capital is scarce, programs like NSRP ASE enable companies to make improvements for a fraction of the cost of going it alone (Navy \$ + teaming + sharing). In light of these facts, NSRP ASE has a unique role in the Navy's R&D posture. Its role in keeping priority R&D requirements current and well publicized, managing a portfolio of projects, and promoting technology transfer and diffusion is particularly valuable in an environment where the Navy program funding structure tends to stovepipe redundant R&D and provide little for high-leverage, cross-platform process R&D.

NSRP ASE has as one of its objectives to achieve Commercial Competitiveness Worldwide. We set a time frame of 5 years to attain this position. Although great strides have been achieved in helping our yards become more competitive worldwide, we are a very long way from achieving this goal. The reasons are many and persuasive. The dollar exchange rate has gone against US exports and foreign governments have increased their subsidies to their shipyards, while the last several years, our Administration has cut Title XI from their budgets. Additionally, our foreign competitors continue with their improvement programs that already had them way ahead of the US when we started attempting to achieve worldwide competitiveness. Despite all these negative forces, some glimmerings of increased competitiveness have emerged. In selected niche markets our US shipbuilders remain competitive. The offshore oil market has seen US exports in recent years. But perhaps the most important benefit to arise from this goal of worldwide competitiveness is the lowering of costs and cycle time to both our Commercial and Navy customers. The need to provide competitive bids for the growing need for additions to US flag tonnage, including the double hull mandates of the Oil Pollution Act of 1990 (OPA-90) and the shuttle tanker market resulting from deep gulf of Mexico oil exploration, are but a few of the markets that will benefit from improved shipyard productivity (Environmental Protection Agency 1990). The collaboration between the government and the large and small shipbuilders in NSRP ASE has begun to bear fruit. How soon our shipbuilders will compete with the huge shipbuilding giants like Japan and Korea is probably a long way off. But there are markets in which we can compete worldwide now, and the NSRP ASE collaboration will provide continuous productivity improvements to help narrow the gap.

Participation in the NSRP ASE Program and supporting NSRP panels has enabled

industry and government leaders to better understand the process, organizational, and technical issues facing US shipbuilders. Can it be said we are on the right path? In isolated areas, yes, the industry has really changed. The greater openness between the companies and our dominant customer, leading to the collaboration of NSRP ASE is in itself is a victory. However, there remains a huge amount to be done. The interface with the Navy, or more correctly, the many interfaces with the Navy result in savings in one area being lost elsewhere. Contracting procedures have not kept pace with changes in business practices. The level and costs of inspection and quality programs are just beginning to recognize the power of such systems as the International Organization for Standardization (ISO). The list of areas that still need work is long and to some, scary. Yes, it is a challenge, but a worthy one. The collaboration of NSRP ASE sponsored by the Navy is the best and most effective vehicle to attain the goal of an efficient, value added and seamless process to build and repair the fleet. The current reality of fleet needs vs. budget shortfalls demands radical change in the relationship between the customer and primary providers – a change from auditor and doubter to collaborator and risk sharer. NSRP ASE has helped illuminate how change within the industry has brought about culture change in a relatively short period – and increasingly obvious is the need for the customer to co-evolve.

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